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Ologists and the Third Man

THE TECHNOLOGY of controlling insects, fungi and other animals and plants inimical to man's welfare has based its success on a wide range of scientific disciplines—zoology, botany, chemistry, physics and even the dreaded Queen of Sciences, mathematics. It has become a complex and specialised subject. And, of course, it now has its own conferences—local, national and international—where scientists and technologists meet in spas, seaside towns and ancient seats of learning to read and discuss papers, to meet fellow workers and exchange ideas, to compare techniques and results.

But when the "ologists" and experts gather together, a Third Man is missing from their deliberations. This Third Man is a very important person for he is the man with a pest problem, the customer who uses pesticides, the intended beneficiary of the fruits of pest control research.

In Malaya this year, the Rubber Research Institute is holding a conference on "Tapping and Yield Stimulation". With such a title it is obviously a conference with a difference. The difference is this: it is not a conference of 'ologists' but a conference of planters—a Third Man conference in fact.

The Rubber Research Institute of Malaya is very much aware that it exists to help planters produce more and better rubber. The object of the R.R.I. in planning a conference of planters is to tap their special information and ". . . to give rubber planters the opportunity of presenting their views and experiences at what might be called ground level.

The soundness of this idea was clearly demonstrated at the excellent one-day Symposium on Industrial Weed Control held last month under the joint auspices of the British Weed Control Council and the Pesticides Group of the Society of Chemical Industry. Mr. S. J. Treen, head of the distribution department of Shell-Mex and B.P. was present and comments on what he wanted to know about industrial weed killers were very down to earth. What, exactly, will they do? How much will it cost? What are the disadvantages? He did not want to know their chemical formulae or the statistical results of field trials. Having got the answers to his three questions he tried total weed killers and found they did what he wanted.

Conferences of 'ologists' should always have at least one paper by a Third Man of such calibre and most aspects of pest control would benefit by conferences of users and customers.

INDUSTRIAL PEST CONTROL IN PORTUGUESE EAST AFRICA

BY I. R. JAMES

MOZAMBIQUE, an important province of Portugal in East Africa, lies as a buffer along the eastern sea board between the Federation of the Rhodesias and Nyasaland and the sea.

The only route to the coast from the three great territories of the Federation, and the shortest route from the Eastern Transvaal district of the Union of South Africa lie through the province, terminating at the ports of Lourenco Marques in the South and Beira, more to the North. Thus these two ports assume considerable importance in the economic picture of the Federation and the Union, handling, as they do, the very considerable tonnage of the two territories' export grain crops, apart from mineral cargoes not subject to pest infestation. Mozambique itself has an important production of oil seeds, beans, millets, copra, cassava and maize, apart from a recent rejuvenation of the banana production. Lourenco Marques is the exit port for the Eastern Transvaal's fruit production, and an entry port for exotic timbers destined for the Union, whilst Beira is the commercial centre of a local indigenous hardwood industry.

Prior to 1951, however, there was no organised fumigation service in Mozambique, apart from a token ship fumigation service at Lourenco Marques maintained by the South African firm which, recognising the increasing importance of the two ports, was ultimately responsible for founding a commercial service in the territory.

This service embraced ship fumigation under international health regulations, the fumigation of grains and cereal products with methyl bromide, the regular spray treatment of warehouses and port storage, spray treatments of the tobacco storage warehouses in Beira by special arrangement with the Rhodesian government and the Tobacco Trade Association, and spraying, fumigation and supervisory services in connection with the special storage alloted to grain and cereal cargoes exported through the marketing boards in the Federation and the Union of South Africa. Domestic services were also provided for, such as the regular treatment of native labourers' accommodation. As the developement of these services progressed, many ancillary services were required and undertaken, such as the fungicidal treatment of ships' holds destined to carry bananas from Mozambique, deodorising treatments in holds and tween decks of ships loading tobacco, fog treatments of ships' holds, protective spraying and dusting of cereal shipments stacked in the open, and fogging of storage sheds.

Mozambique itself was an ideal field for the pest technologist. There was a general high degree of insect infestation in stored products, a high incidence of public health pests, such as bed-bugs, cockroaches and rats. Insect populations bred in optimum climatic conditions, and were relatively untouched by modern insecticides. At all times an endeavour was made to assess the problems met with in an impartial manner, and to avoid applying stereotyped principles to the solution of the problems.

There were numerous local factors to be taken into account when recommending treatments, such as local trade practices, climate, national temperament, economic considerations, and the fact that it was, as stated, a virgin field where bold and imaginative action could be taken.

The Province possessed a mill which was generally acknowledged by overseas visitors to be a showpiece. The installation was very modern, well-run and eventually an adjacent macaroni factory was built, but insect infestation had always been a problem. Prior to 1951 the mill was the sole user of methyl bromide in Mozambique, possessing four silos fitted with a circulatory fumigation system. With the formation of an organised pest control service, the mill boldly accepted all pest control proposals put to them, gave courteous and careful consideration to all recommendations by the pest control contracting firm and were eventually rewarded by an installation free from insect pests. In a climate particularly favourable to the rapid development of infestation, this was a demonstration of the results which can be achieved by wholehearted co-operation between a client and a pest control contractor.

Rodent control proved an active field and one in which considerable success was achieved by the use of baits, and the Calcid form of calcium cyanide.

Different territories bring their own problems and bats proved to be a problem, if not entirely peculiar to ours, one in which pest control services were constantly invoked.

Another field, naturally offering in that part of Africa, was that of termite control. The policy followed was that of barrier treatment using pentachlorophenol solutions, it not being thought entirely satisfactory to offer a cheaper treatment based on dieldrin or toxaphene, in the absence of authoritative data on the behaviour of these insecticides for soil treatments in Portuguese East Africa. In fact, the high incidence of infestation, plus the fact that buildings had been constructed with very little regard to precautions against termite attack, soon indicated that spot treatments would never be satisfactory. A full service, based on the complete protection of the premises and embracing drilling and injection of concrete slab floors, where necessary, was eventually initiated, carrying a five-year guarantee. Using pentachlorophenol solutions, these treatments were necessarily expensive, and very few contracts were carried out for private householders. The emergence of this state of affairs was, of course, due in some measure to the national temperament of the public. An attempt was also made to interest architects in the pre-treatment of building sites.

In the public health field, the utmost and constant help and assistance was shown to the contracting company by the municipal health officer, whose department always took a lively interest in new methods and materials. However, it soon became apparent that the department's powers were severely curtailed by strict financial limits, and much that could have been put right had to be left undone.

Bakeries, hotels and restaurants generally resorted to pest control services when forced to do so by the health inspectors.

On the retail market, the aerosol bomb reigned supreme in the do-it-yourself field, and was used lavishly, indiscriminately and without recourse to the directions on the label. This was amply demonstrated by a case where a pet cat was thoroughly sprayed with an insecticidal resin lacquer.

Technical notes

Some notes on technical details may be of interest to readers. Grain fumigation was carried out with methyl bromide, malathion emulsifiable concentrates being used for the treatment of wall surfaces, except in cases where neighbouring government authorities specified the use of Lindane. The fogging of warehouses was usually carried out with a 3% malathion fog solution applied either through a light-weight Tifa machine or, where more convenient, through a Swingfog.

Rodent control was based on the use of Warfarin baits, these being prepared by the contractors, from the concentrate, using local materials, such as coarse ground maize meal and crushed sunflower seed. Baiting was combined with gassing, using Calcid, and occasionally a particularly heavy infestation was reduced by a one-day baiting programme using thallium sulphate, followed by the usual Warfarin programme.

Ship fumigation was carried out with Zyklon discoids.

Agricultural services are properly not within the scope of this article, and it will suffice to say that much liaison work and research was done in conjunction with the Department of Agriculture, apart from supplying materials and equipment. It is noteworthy also, and indicative of the deep interest shown and help extended by the department that the contracting firm was able to provide the first commercial air-spraying services in Mozambique. Indeed the ever ready and whole-hearted co-operation and assistance received from the Portuguese Department of Agriculture greatly assisted the rapid developement of modern commercial pest control services in Mozambique.

Versatility of African company

The essential difference which comes to mind, when comparing the activities of a pest control contracting firm in Africa, with its counterpart in the United Kingdom, is the extraordinary versatility which the African organisation must possess.

In a vast and developing territory such as Portuguese East Africa, possessing only one qualified and full scale commercial pest control company, that company must be entirely flexible in organisation and operation in order to meet the challenge of constantly changing conditions, and the new problems which arise daily. Its activities must range from the large scale fumigation of tens of thousands of tons of cereal produce, frequently at short notice and under difficult conditions, to minor but important services such as fungicidal spraying of banana storage, germicidal treatments after infectious illness, tracing elusive smells in private houses, arranging demonstrations of tobacco seed bed fumigation, carrying out research on weed-control, travelling a thousand miles to advise on the construction and operation of fumigation chambers and tendering for government requirements.

In Africa, the usual service team consists of one or two Europeans and a squad of trained Africans. The Africans carry out the rough work, such as man-handling plastic sheeting, cylinders and heavy equipment, and the European in charge is left with more time and a freer mind to tackle problems which may arise.

For their size the ports of Lourenco Marques and Beira possess fumigation services the equal of those in any other port in the world.

World distribution of termites is not static, and immigration is still occurring in some parts of the world.

THE RECOGNITION OF TERMITE DAMAGE

BY W. VICTOR HARRIS, M.Sc. F.I.W.Sc.*

Fig. 1. Dry-wood termite community (Kalotermes jouteli) *A. eggs; B. young nymph; C. worker (older nymph); D. queen; E. soldier; F. excreta pellets. Photo W. V. Harris.*

TERMITES are well known as pests of woodwork of all kinds throughout the tropics. It is perhaps less generally appreciated that they constitute a great menace to a wide range of manufactured articles such as books and fabrics, and those fashioned from leather, natural rubber and many kinds of plastics, especially when any of these are kept for some time in a termite-infested building. Outside the tropics termites are much less active, but they have a nuisance value wherever the normal summer temperatures are sufficiently high and prolonged to allow them to breed. In Europe termites are found as far north as La Rochelle on the French Atlantic coast, throughout Spain and Portugal, along the Riviera to Italy from the Alps southwards, in the lower parts of the Balkan Peninsular as far north as Belgrade, and the coastal areas around the Black Sea. The establishment of a North American subterranean termite in Hamburg serves to indicate that the distribution of termites is not static, and that accidental introductions are still taking place, though fortunately these but rarely lead to the naturalization of the immigrant termite.

Increase in termite damage during the past fifteen years has been due to the greater opportunities which have resulted from the rapid development of "permanent' housing in many tropical countries, and the increase in personal possessions which accompanies a rise in the standard of living. No better measure of this increase can be found than the recent spread of pest control operators in countries where, before the War, they were quite unknown. When houses for the masses were built of local materials, cheap and transitory, termites were accepted as part of the natural order, but now when so many houses are built as part of government housing

* *Officer-in-charge, Termite Research Unit, London.*

schemes or on mortgage, the control of termite infestation is essential in order to prolong their life to the economic minimum, if no longer.

As in other branches of pest control correct diagnosis is essential if the treatment of termite damage is to be efficient, and further damage is to be prevented.

Diagnosis is simplified if termites can be found, and recognised, in association with the damage. Termites are social insects and exist only in family group which are made up of a number of different forms or castes. A single termite of any caste does not have a life of its own, for all practical purposes, but only in so far as it is part of a balanced community. New communities arise when two mature winged termites, one male and one female, join forces to excavate a small chamber in wood or in the soil according to which group they belong, where they will be undisturbed during the early stages of producing a family. Having shed their wings at the outset, these parents exist on their internal food reserves until the first of their brood have reached the stage of feeding themselves and then feeding their parents. For some considerable time the offspring grow into worker termites, with about one in ten becoming soldiers. Reproduction, food and shelter, and defence are the separate functions of the three distinct castes. Populations in mature communities vary from a few hundreds in the case of dry-wood termites to several millions for those responsible for the giant mounds found in many tropical countries. Specific determination depends on having available specimens of either winged termites or soldiers, and preferably both together. All stages, however, may be placed without much difficulty into one of the six families into which the order *Isoptera* is at present divided.

Flying termites are easily recognised by their four wings all of similar size, shape and vein pattern. Each wing has a characteristic groove running crosswise near the end which is attached to the body, and this is where breaking takes place when the wings are shed after swarming. A slight muscular effort on the part of the termite causes the wings to drop off rapidly and cleanly, in a way which no other insects can do and all that remains on the now wingless creature are four small triangular scales attached to the thorax. The jaws, or mandibles, are strong, triangular and toothed on the cutting edge somewhat similar to the jaws of cockroaches and locusts. The once-winged parents of a community, popularly known as the king and queen, remain at the head of the family for many years. The male changes little in appearance, but the female increases in size as her abdomen stretches to accomodate her egg-laying apparatus. Dry-wood termite queens are not greatly enlarged because their families are small (Fig. 1). Mature queens of the large mound-builders of Africa and south Asia may attain a length of 5 in. because their families run into millions, and their rate of egg production reaches one every two seconds, or 1,800 per hour. (Fig. 5 (b).

Worker termites are in general pale, fragile-looking, little insects. Their rounded heads are frequently yellow or brown in contrast to their white or cream bodies. None of the species which feed habitually on timber has eyes. All have small but strong mandibles similar to those of the adult insect. Apart from the mandibles the worker termite is in external appearances a case of arrested development. Usually two moults are undergone to reach the worker stage, but six or seven are required to become a flying adult termite.

Soldier termites have only slightly tougher bodies than the workers, but they have characteristically large, hard heads of quite distinct shapes and, with one exception, strong cutless-like mandibles. The exception is found in some tree-nesting or mound building termites whose soldiers have developed pear-shaped heads for squirting a viscous fluid over their enemies, with corresponding diminution of the mandibles. Dry-wood termites of the genus *Cryptotermes* have soldiers with hard black cylindrical heads which are used to plug up exit holes and the finer galleries in case of attack.

Worker termites, with or without an attendant guard of soldiers, are found away from the colony collecting food. In the nest itself, and in the nursery galleries of dry-wood termites, are to be found all the immature stages —white creatures of various sizes and stages of development dependent on the workers for partly digested food, and on the high humidity within the nest to protect them from dessication. When a community has become well established after a period of years, immature stages begin to appear with wing buds and in course of time these become winged adults which will leave the nest as a swarm to found new colonies.

The three main groups of termites associated with damage to buildings and their contents are:-

1. Dry-wood termites—*Cryptotermes, Kalotermes and Neotermes.*
2. Moist-wood termites—*Coptotermes, Reticultitermes,* and *Heterotermes.*
3. Ground-dwelling termites—*Amitermes, Microcerotermes, Macrotermes, Odontotermes, Microtermes, Nasutitermes.*

The term "subterranean termite" is used for termites which are not dry-wood species, and tends to refer to quite different kinds in different parts of the world. Ground dwelling termites may live completely underground, or may have their nests inside mounds of various sizes and shapes on the surface of the ground. Some belonging to this last group have adapted their nest construction to permit them being built on the trunks or branches of trees.

Fig. 2. Leg of chair infested by dry-wood termite Cryptotermes *with characteristic heap of excreta pellets on carpet below hole (marked with arrow) made for this purpose. Photo W. V. Harris.*

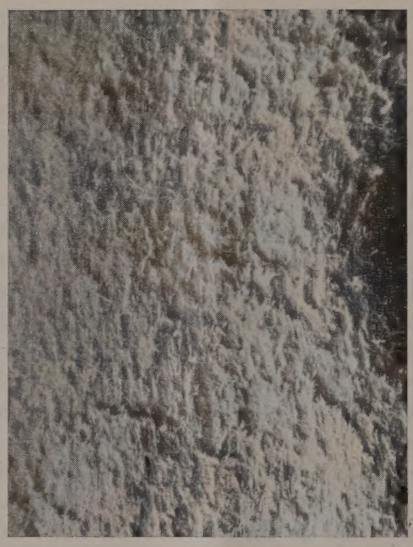

Fig. 3. Surface of cocoa tree eaten by the large mound-building termite, Macrotermes, *greatly enlarged.*

Fig. 4. Cotton material from a bale damaged by ground-dwelling termites, showing characteristic earth lining of the galleries. Photo W. V. Harris.

TERMITE DAMAGE

The division of termites into two major groups according to their mode of life is of great practical importance. The dry-wood termites live *inside* the wood on which they are feeding. The galleries which they excavate in order to obtain food are then used to shelter the community. The wood they eat is digested with the aid of protozoa that inhabit their gut, and if they loose these protozoa for any reason they die of starvation. Dry-wood termites do not come out into the open except when winged adults swarm. At other times the workers may make small openings on the surface of the woodwork so that they may tip out excreta pellets from their galleries, but these holes are quickly closed again. (Fig. 2.)

The moist-wood and ground-dwelling termites, by contrast, have a central nest system usually in the ground, from which the workers move out in search of food, and to which they return with their loads. Other workers have different duties, such as building and attending to the brood. The moist-wood termites have intestinal protozoa to help them digest their food, while the ground-dwelling termites rely on a variety of methods ranging from the cultivation of fungi on food stocks to intestinal bacteria. When it is not possible for termites of either of these type to pass from nest to food supply by way of simple galleries excavated in the soil, they will construct shelter tubes or covered runways over the surface of the inhospitable material until they can once again get safely inside the wood on which they wish to feed. These covered ways protect the worker termites from ants and similar enemies, and from the dessicating effect of sun and moving air. The covered runways of moist-wood termites are built mainly of fragile "carton" material made from excreta containing a large proportion of partially digested wood. Those of ground-dwelling termites are either of soil particles cemented together with a mixture of clay and saliva, or of dark brown carton formed from dried excreta containing a high proportion of lignin, depending on the nest building habits of the particular termites. All subterranean termites have a tendency towards filling up their excavations behind them with some earth, or of constructing cross walls of carton in order to preserve some degree of rigidity in the outer walls of the piece of timber in which they are operating.

External evidence of termite attack

Dry-wood termites provide two indications of infestation, the first of which is the presence of small holes on the surface of the woodwork, about 1.5mm. (1/16 in.) in diameter, usually closed by a plug of pale coloured material which darkens with age. The second indication is the presence of heaps of excreta pellets on the floor below, pale when fresh but darkening with age. Individual pellets are like seeds about 1mm. long, with rounded ends and small depressions around the side. Small heaps of pellets have been found on the surface of carpets when the floor beams below have been infested and the termites have burrowed upwards in order to clear out their galleries. The leg of a chair infested by dry-wood termites is shown in Fig. 2.

Subterranean termites are indicated by the presence of covered runways over painted surfaces, or over neighbouring brickwork or plaster. Softwood in contact with the ground will have no visible runways as a rule, but will be entered from below. In fact in the great majority of cases termite infestation is only recognised when woodwork collapses under strain, for example during high winds or when subjected to the stiletto heels currently fashionable.

Internal evidence of termite attack

As workers of all the various kinds of termites normally attacking timber have mandibles of similar pattern, they produce a uniform surface on their galleries and workings. Their mandibles have sharp points with which they tease out the individual wood fibres, and grinding plates on the bases which cut the fibres as required.

Damaged timber examined under the microscope or hand lens has a regularly roughened appearance, due to the cut ends of the fibres sticking up to form a pile. The similarity of dry-wood termite eaten surfaces with those produced by ground-dwelling species will be seen on comparing pine wood eaten by *Kalotermes* in Fig. 1 with cocoa stem eaten by *Macrotermes* in Fig. 3 Termites excavate along the grain, except when dry-wood termites make their tunnels towards the exterior at swarming time or for dumping excreta. The harder medullary rays, knots and heartwood are avoided, and cross-walls are left at intervals to ensure the stability of the thin outer layer of wood left to protect the termites. The larger mound-building termites of Africa and Asia are gross destroyers of timber and fill the voids left by removing all the interior of a beam or post with tightly packed hard earth, in order to maintain its rigidity.

Dry-wood termite attack produces a series of coalescing galleries, cleanly cut out with no foreign matter introduced into them, apart from accumulations of excreta pellets already described. Narrow galleries will be found at intervals leading to the surface, their orifices plugged with chewed wood.

Moist-wood termites excavate their galleries to produce a series of shallow spaces separated by thin floors. They use their excrement, which dries to a pale carton-like material with much partly digested wood in it, to make extra cross-walls, to seal off galleries no longer in use, and as already described for run-ways. Timber damaged by the tropical *Coptotermes* is characterized by the numerous thin divisions between galleries and the dun coloured carton in pillars or plastered on the walls of the main lines of communication.

The mound-building or subterranean nesting termites typical of Africa and South Asia bring up soil in greater or lesser amounts into the large galleries they excavate in order to preserve some rigidity in the structure. Commonly this is a red lateritic subsoil which makes diagnosis simple. Similarly when they get into bales of cloth, books or the cardboard cases of general merchan-

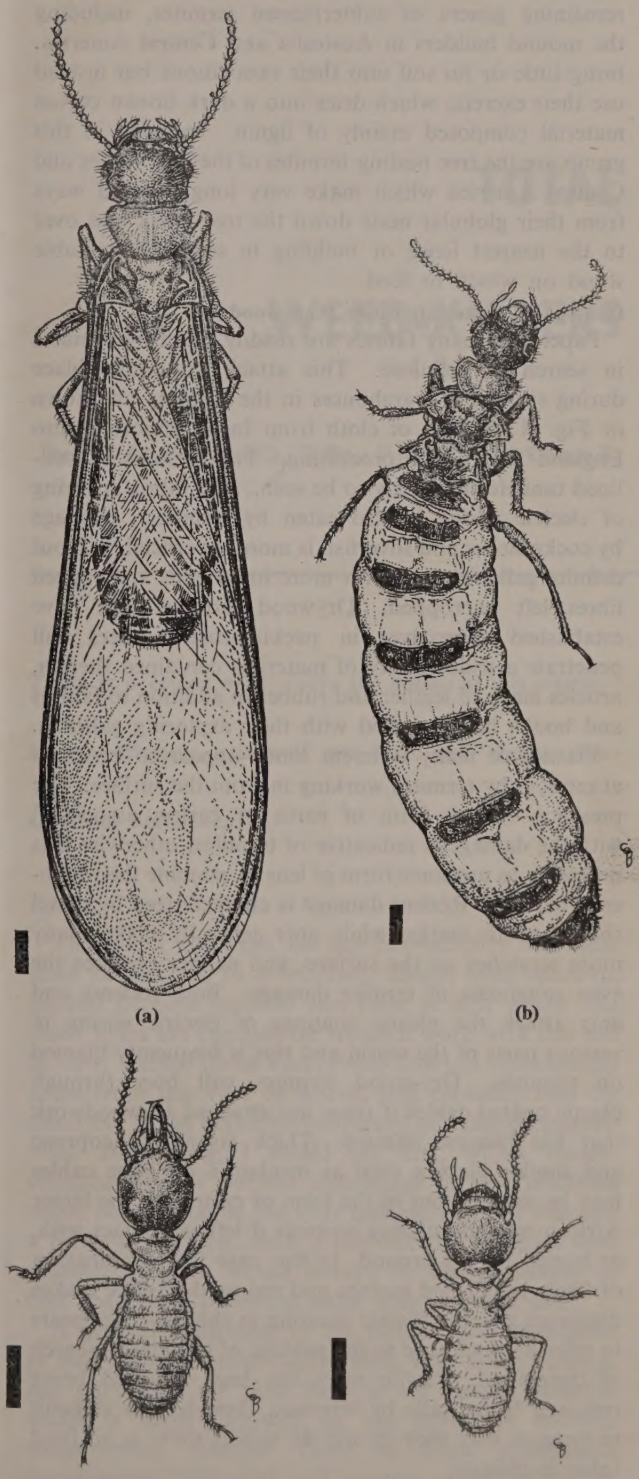

Fig. 5. An African ground-dwelling termite, Ancistrotermes latinotus, *which does much damage to timber in contact with the ground. (a) winged adult; (b) queen after several years of egg-laying; (c) soldier; (d) worker. The small black lines indicate 1. mm.*

dise left unprotected, the presence of soil indicates the type of termite implicated, as shown in Fig. 4. The remaining genera of subterranean termites, including the mound builders in Australia and Central America, bring little or no soil into their excavations but instead use their excreta, which dries into a dark brown carton material composed mainly of lignin. Included in this group are the tree nesting termites of the East Indies and Central America which make very long covered ways from their globular nests down the tree trunk and over to the nearest fence or building in search of suitable wood on which to feed.

Damage to materials other than wood

Paper and many fabrics are readily eaten by termites in search of cellulose. This attack may take place during storage in warehouses in the tropics, as shown in Fig. 4 which is of cloth from India imported into England for further processing. The remains of soil-lined tunnels are clearly to be seen. The fabric covering of electric wiring is also eaten by termites. Damage by cockroaches and silverfish is more superficial, without definite galleries, and with more loose ends and ragged fibres left uncropped. Drywood termites that have established themselves in packing-case timbers will penetrate a wide variety of materials contained therein, articles made of leather and rubber in addition to fabrics and books being riddled with their exploring galleries.

Plastics of many different kinds appear to be eaten at random by termites working in from the surface. The presence of any form of earth or carton associated with the damage is indicative of termites, otherwise it is necessary to use some form of lens to examine the roughened surface. Rodent damage is characterized by chisel shaped tooth marks, while ants generally make many more scratches on the surface, and neither produce the even roughness of termite damage. Both rodents and ants attack the plastic coatings of electric wiring in various parts of the world and this is frequently blamed on termites. Dry-wood termites will bore through plastic coated cables if these are attached to woodwork that has become infested. Thick layers of neoprene and similar plastics used as insulation on large cables may be scooped out in the form of craters by the larger African mound-building termites if left in contact with, or buried in, the ground. In this case the combination of finely roughened surface and red earth residue makes diagnosis simple. Plastic sheeting in thin layers appears to offer no hindrance to the passage of termites in search of their food. Plastic paint has been reported being removed from walls by termites, though it is difficult to imagine why they should do this as there is no food value in plastics.

Where to expect damage

Altogether some 110 different species of termites have been recorded from various parts of the world as damaging buildings, furniture and fittings, and of these fifty appear to be regular pests. This number will increase with our knowledge of the termites of some of the less well developed areas of the tropics.

Dry-wood termites are serious pests on most tropical islands and along the coasts of America, Africa, Asia and Australia where these lie in the tropics. Over 100 miles away from the sea buildings appear to be free from attack, although "wild" species may be present in dead branches of trees. Various species of *Cryptotermes* have been spread around the tropics by man until their original homes are matters for speculation. One of the most destructive, *Cryptotermes brevis*, the West Indian dry-wood termite, is now widely distributed, and not infrequently turns up in Britain in timber. Recently it has been found in furniture from Trinidad brought to London. Its nearest established location to Europe appears to be the island of Madeira. Bermuda suffers from a related species. In the far East, *Cryptotermes* species are pests from Hong Kong south to the Northern Territory of Australia.

Moist-wood termites have adapted themselves to climates much cooler than those of the tropics. *Reticulitermes* species are found in southern Europe, China, Japan and the U.S.A. They are replaced by the related genus *Heterotermes* in northern India, Central America and the Caribbean. Then in the humid tropics *Coptotermes* is widespread, doing much destruction. Since moist-wood termites usually nest in an excavated piece of wood which stays damp, such as a tree trunk buried in the soil, or the base of a fence post, it is not surprising that they can make their nest away from the soil if the site is sufficiently moist. *Coptotermes* nests in the timbers of buildings if they are kept damp by leaking pipes, or by such heavy condensation as is to be found in cold stores. They are not uncommon in wooden boats, particularly in the Far East where *Coptotermes formosanus* is prevalent. This latter termite is now found in Simonstown in South Africa, believed to have arrived in ship's dunnage later sold for firewood.

Ground-dwelling termites are general throughout the tropics, including deserts, but not above 8,000ft. in altitude, or in salt marshes. They are most noticeable in the drier savanna areas where moist-wood termites are few or absent. They include the builders of tall mounds, so conspicuous in many places, but the most damage is done by smaller species which live in inconspicuous subterranean nests.

Merchandise may be damaged while awaiting shipment in tropical and sub-tropical ports. It may be damaged in transit, within the tropics, by dry-wood and damp-wood termites infesting the ship's timbers. Damage by ground-dwelling termites can only take place in contact with the ground, and will cease once the articles have been removed from such contact.

TOTAL WEED-KILLERS

By M. A. PHILLIPS, D.Sc., F.R.I.C., M.I.Chem.E.

There is a crying need— says the author of this article— for an effective, relatively non-toxic and cheap, wide-spectrum herbicide. . . .

THE PURPOSE of total weed killers, or non-selective herbicides, as they should be called, is to get rid of a large range of unwanted plants. As no herbicide exists which can be guaranteed to destroy all plants under all conditions, a range of "total" weed killers is available—no single one satisfies the term "total" completely.

Most non-selective herbicides would in fact, when used at lower concentrations and in the right conditions, probably be selective and most selective herbicides, for example, the 2, 4-D and 2, 4, 5-T type, would at higher concentrations, have a far wider spectrum of action.

These facts, together with the cost of the chemicals and the cost of their application must be borne in mind when interpreting the Table I.

With reference to Table I., note the high cost of borates which precludes their field use and the impracticability of using undiluted chlorate which is cheap and effective but has the hazard of inflaming organic matter. Mixtures of borate and chlorate are hence popular.

Amongst the higher cost of materials, there are ammonium sulphamate—a rather costly method of using sulphuric acid—and almost equally corrosive, monuron, the cost of which is so prohibitive that the manufacturers do not advise its use alone but admixed with sodium chlorate, for example, for total weed destruction.

The lower costing materials, of the order of some 100s. per acre or less, all have objections. Sulphuric acid is not popular on account of its danger to humans and animals in use, corrosion of machinery, etc., and the cost 25s. per acre is hence a fictitious one. Pentachlorophenol is primarily a pre-emergent herbicide and for use with certainty for total weed destruction would cost much more than is indicated in the table; the same is true of other materials.

Amino-triazole, simazine and a few other herbicides are sometimes classed with the total weed killers but are really herbicides with a wider sprectrum than some others; they are not cheap and to act as non-selective materials need high dose rate application.

There is little doubt that there is a crying need and a ready market for an effective, relatively non-toxic and cheap wide-spectrum herbicide, costing say, no more than 200s. per acre and possessing some degree of persistence, without being a soil sterilising agent.

The search, therefore, for new non-selective herbicides must be directed to a relatively cheap, wide spectrum general purpose material and there is little doubt that many firms are engaged on research work with this end in view. Diquat (from Plant Protection Ltd.) presumably arose from this type of search, and probably also the discovery of the herbicide properties of dichlorobenzonitrile. In passing, I would say that, within reason, cheapness under current conditions of raw materials costs, should not be the only consideration in selecting a field for research, since if any effective material were discovered, there would always be the possibility of cost reductions following large scale manufacture.

A general knowledge of the subject, and attendance at many weed control conferences, with much reading, has convinced me that there is no master principle which is being followed by any group of research technologists, whether these be from government departments, industrial pest control organisations, or university teams. Some general principles are well known, such as the potentiating effect of a nitro

group or a chlorine atom or two introduced into organic molecules, but no one seems to have applied certain principles of chemotherapeutic research or of animal and veterinary studies to plants, although it is well known that all protoplasmic life is basically of the same nature.

Hence, most research has been confined to the exploration of chance observations, mainly in the agricultural and horticultural field and in these circumstances, the use of this "blunderbuss" method is as likely to be effective as any other non-systematic method and success is as likely, or unlikely, for any organisation, whatever its size or influence.

With these thoughts in mind, my suggestions for research, with a reasonable chance of some success following two or three years of laboratory work and limited field trials, are summarised below.

1. Attention should be given to the strong possibility that mixtures of known herbicides may be more effective than either alone or that "synergists" might be incorpor-

TABLE 1.

"Total" Weedkillers

Compound and unit price	*Amount used per acre approx.*	*Cost per acre approx (shillings)*	
Borax (£50)	1 Ton	1,000	Not for field use: soil sterilisation, paying work, etc. non toxic to mamals
Sod. chlorate. (£75. per ton)	200 lb.	134	Fire, hazards, never used alone.
Typical borate/ chlorate mix.	—	250-300	Fair compromise at reasonable cost.
Inorganic acids e.g. sulphuric acid (£11 per ton	300 lb.	25	Very toxic, very corrosive. acre cost fictitiously low taking hazards and machine upkeep into account
Ammonium sulphamate (2s. 6d. per lb.)	240 lb.	600	Mainly used in forestry; too expensive for field use. Toxic, corrosive.
Sodium arsenite	—	—	No longer used and not quoted.
Sodium nitrate	3 cwt.	84	Little used; not controllable.
Cresylic acids (9d. per lb.)	Variable	75	Mainly pre-emergent use. Toxic to mammals.
Pentachlorophenol (2s.2d. per lb.)	50 lb.	100+	Pre-emergent use; has wider spectrum used in larger amounts.
Vaporising oils (2d. per lb.)	480 lb.	80	Unreliable in use.
Monuron (25s. per lb.)	25 lb. min	625+	Very expensive, not for field use unless in mixture.
Diquat (Reglone)	not finalised.	250-300 based on 55s. for limited use	For potato haulm destruction (55 lb. per acre—may prove to have wider spectrum)
DNOC (3s.)	20/40 lb.	60	Highly toxic to mammals; has been used for general purposes at high dose rates.

TABLE 2

Known compounds which may have phytotoxic and herbicidal properties.

Beta naphthol and ethers	Azobenzene
Beta-naphthylamine	Acetanilide
Nitro naphthols	Alloxan
Nitrophenols	Allyl alcohol
Nitro so-beta-naphthol	Allylamine
Oxamide	Allyl cyanide
Phenyl mercaptan	Allyl thiocyanate, cyanate
Phenyl isothiocyanate	Arsanilic acid
Phorone	Benzidine
Picrin acid	Benzil
Pinacol	Quinone
Piperonal	Benzotrichloride
Pyridine	Bromoacetic acid
Pyruvic acid	Brucine
Ricinoleic acid	Butyrolacetone
Safrol and isosafrol	Caprolactum
Semicarbazide	Cacodyl oxide and acid
Stilbene	Chloral (hydrate)
Succinimide bromosuccinimide	Chlorobutadiene
Thioglycollic acid	Chlorohydrin
Thiourea	Coumarin
Trichlororesorcinol	Cumene
Trinitrophenol	Cyanamide
Uracil thiouracil	Cyanic acid
Cyanuric acid and chloride	Indoxyl
Cyanogen bromide	Iodoacetic acid, amides, esters
Diacetyl	Iodoform
Dicyandiamide	Diketene
Dinitroresorcinols	Linolenic acid
Dinitrosalicylic acid	Maleic anhydride
Alkyl isocyanates	Phthalic anhydride
Fluorobenzene	Malic acid
Furfural	Mesityl oxide
Furyl alcohol	Methyl uracil
Glyceryl nitrates	Derivatives if known, di & trichloroacetic acids
Guanidine (Carbonate)	Diazomethane
Hippuric acid	Nitro acetic acid
Hydantoin	Nitro alkanes and nitro alkanols.

TABLE 3.

Tentative short list of chemicals for screening as herbicides.

1. *New formulations of known boron organic compounds.* Organic boron compounds are now well-known as a result of military and space research on rocket fuels; they are rapidly becoming relatively cheap and will be much cheaper in the future and boron is not inherently a dear basis for this work.
2. New organo boron compounds.
3. Selection of dichloro compounds of phenols and of nitro compounds and nitro phenols. Phenols, nitro phenols, chlorine are all cheap.
4. Nitro paraffin formulations.
5. Basic esters of known herbicides of the 2, 4-D type; formulations. Amino, acylamino and similar alkylol esters.
6. Organic arsenic compounds. Some of these are (relatively) quite cheap as starting materials, e.g. p-hydroxy phenyl arsonic acid (sodium), commercially available, 3-N tro-4-hydroxyphenylarsonic acid, esters, nuclear-chorine substituted compounds derived from these. This interesting series is based on the fact that inorganic arsenic compounds are effective non-selective herbicides and that organic arsenic compounds are known to be of considerably lower mammalian toxicity than in organic ones.
7. Fluoroacetamide at concentrations higher than those used to kill insects is phytotoxic and certain of its cheap derivaties are known to be very phytotoxic. There is probably sufficient data available, to warrant patenting formulations without undue delay—this would be an entirely new series and would break new ground.

ated with known herbicides following perhaps the now well-known effect of thiocyanates on aminotriazole. A "synergist" which reduced the effective dose of a known selective material could possibly make normal concentrations of this sufficiently non-selective for the purpose. Such formulations might be patentable.

2. The question of correct formulation of herbicides is also of the greatest importance particularly the choice of a wetting agent which I regard as a *sine qua-non* of correct formulation.

3. If a known chemical compound were found to have hitherto unsuspected herbicidal properties, formulations of it and even simple mixtures would be patentable.

4. The ideal discovery from a manufacturer's point of view would be a new compound shown to have herbicidal properties, which could then, together with its formulations, be protected by very strong patents.

5. The selection of candidate non-selective herbicides from the vast number of known chemical, compounds presents great difficulty and one can only advise on general principles (such as those compounds possessing nitro or chloro or multi chloro groups, thiol groups, cyana groups, cynato and thiocyanato groups) and on hunches and chance observations. Table 2 presents a limited but by no means exhaustive list, and is intended purely by way of illustration.

6. In Table 3 is given a list of what are thought to be new compounds or series of compounds from which potential herbicides might be selected.

7. There is clearly the need for much work first in the laboratory to screen further any short list made from the above suggestions and later on to organise and carry out field tests, formulations, etc.

8. If this work were to lead not to a useful non-selective but to a selective herbicide (or maybe to both types), it would still be well worth while.

In conclusion, I would say that some determined research, not too closely scheduled at the start, could well with a little patience lead to a novel, patentable product which could compete with anything in use at the moment and might even prove to have exceptionally useful properties. No estimates of cost can, of course, be given until the dose rate is determined and even a product of relatively high cost per lb. might be practicable if it were highly phytotoxic and in any case, costs of production have a habit of falling rapidly when there is a large demand.

Footnote:- The substituted ureas and the triazines (simazine and atrazine) are now established as excellent non-selective herbicides (although the term non-selective has to be qualified as suggested above); they are considered by many to be too expensive for field use and are mainly used by railways and electrical undertakings where efficiency is a main, and price a secondary, consideration.

TIMBER PRESERVATION IN JUGOSLAVIA

By Prof. M. Antunovic Kobliska,*A.M.I.M.E

GEOGRAPHICALLY, Jugolsavia belongs to the zone of mixed forests except for a fringe of Mediterranean vegetation along the Adriatic coast and a sprinkling of Alpine flora in the northernmost part of the country. About 30 per cent. of the country's total land area is forest land. There are several native oaks, of which the most important is the European oak (*Quercus pedunculata E*). Beech (*Fagus moesica L*) and *Fagus silvatica L* is widespread, especially in the Republic of Serbia, and it is often mixed with fir, pine, birch and spruce. Many other broadleaved kinds are represented—maple, elm, ash, acacia, poplar, etc. There are a number of native conifers—black pine, white pine, maritime pine, fit, spruce, birch and larch. There are also two varieties of pine characteristic of the Balkans, the white barked pine (*Pinus leucodermis M*) and the spruce-like pine (*Pinus puce Gris.*), and the very rare Serbian spruce (*Pinus omorica Panc.*) confined to a forest reservation in Serbia. Representing about 70 per cent. of the total grown stock, broad-leaved forests are considerably more widely distributed than coniferous forests, so that Jugoslavia is predominantly a country of broad-leaved forests.

It is estimated that the annual growth amounts to about 19.5 million cubic metres of wood, whereas the annual felling is at present about 14 million cubic metres, broad-leaved timber representing about 10 million and coniferous timber about 4 million cubic metres respectively.

The problem of the present and future supply of home grown timber for domestic use and export is a subject of serious study in Jugoslavia as a result of increasing demands for building timber, mine timber, railway sleepers, telegraph and transmission poles, woodware and wood for the chemical industries, including the cellulose industry. Consequently the forest policy of Jugoslavia is directed to improving the timber resources of the country, including considerable afforestation and

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melioration of devastated areas, and the introduction of forest plantations with agricultural crops. As a result of this policy timber preservation in Jugoslavia is gaining ground, being recognised as an important factor both in the interest of the consumer and the national economy.

Timber preservation in Jugoslavia is carried out by practically all known methods of preservative treatment, preservatives and fire retardants.

Railway sleepers were formerly pressure treated both with creosote and water-borne preservatives, especially zinc chloride, as well as with water-borne preservatives in combination with creosote. During the first few years after the last war mixtures of beech wood tar oils, and beech wood tar oils mixed with light petroleum oils were temporarily used with moderate success. Since 1954 all Jugoslav timber impregnating establishments are using only coal tar creosote for the impregnation of railway sleepers. The process employed is the same in all establishments in accordance with Jugoslav railway specifications. Both the normal Rueping empty-cell process and the double Rueping empty-cell process are used, the former mainly for oak and pine sleepers, whereas for beech sleepers both processes are used. There is a tendency, however, to confine the treatment of beech wood sleepers to the double Rueping process. Water-borne preservatives are no longer used for the imprgnation of Jugoslav railway sleepers.

Telegraph poles and electric transmission poles are treated by more than one of the processes normally used for the purpose. Telegraph poles were creosoted by the Rueping process, and so far for the most part were transmission poles. There is a tendency in more recent years, however, to treat both telegraph and transmission poles with water-borne preservatives as more effective than with creosote. Considerable numbers of transmission poles are already treated with water-borne preservatives, by both the full-cell pressure treatment, the Boucherie sap-displacement treatment and to some extent the osmose treatment. The last two processes are mostly used in the Republic of Slovenia, where mobile tanks for the Boucherie treatment have been found very useful. The preservatives used are mostly of the fluor/chrome/arsenic type. Local treatment of telegraph and transmission poles is on the increase; preservative bandages, top caps and to some extent preservative cartridges are all used.

Methods of mine timber preservation

Preservative treatment of mine timber is increasing. It is mainly limited to the non-pressure methods. both steeping and the hot and cold open tank methods being used. Preservatives in use include sodium silicofluoride, chromated sodium silicofluoride and fluor/chrome preservatives. Only a small percentage of mine timber is treated by timber impregnating establishments, the bulk of the mine timber being treated locally at the mines to meet individual needs for treated timber.

Preservatives in good supply

Although several impregnating establishments provide for the preservation of sleepers, poles, etc., comparable protection of timber used in building has not yet become general.

There are sufficient quantities of timber preservatives available in more recent years thanks for the most part to the development of the Jugoslav chemical industries. The annual consumption of creosote is already about two-thirds covered from domestic sources, whereas the water-borne preservatives, including the Wolmanite reform salts, are still mostly produced from imported ingredients. As chrome ores are mined in Jugoslavia and there are growing supplies of fluoride by-product from the super phosphate fertiliser industry, the production of fluor/chrome preservatives from domestic sources is likely to be ensured in the near future. Pentachlorophenol and its derivatives, and other products of the organic solvent type are also produced in the country. Specifications for timber preservatives are given in the existing Jugoslav standards for the creosote and fluor/chrome/arsenic preservatives respectively.

Forest products research station

Research in the field of timber preservation is carried on in several Jugoslav institutions, including universities.

The Forest Products Research Institute in Zagreb, however, was founded as the central timber research body in the country. The experimental station for timber impregnation allotted to Jugoslavia by the F.A.O. in 1953 is attached to the Institute. Slavonski Brod was chosen as the most suitable site for the station both because of its approximately central position in the country and its proximity to one of the largest timber impregnating establishments. It has a chemical laboratory, a mycological laboratory and a laboratory for semi-industrial impregnation of timber; the treating cylinders of the latter were supplied by a British firm of manufacturers. Some very useful work has been carried out in the station for the benefit of the timber preserving establishments, both in the preservation of railway sleepers and telegraph and transmission poles, the local treatment of poles and the protective treatment of logs in storage. The station is authorised to issue certificates for preservatives which are tested in the laboratory and in the field. The Institute is also noted for its research on processing methods, especially in the surface finishing of woodware, the latter holding an important place among the finished products of Jugoslavia's woodworking industries.

The Forest and Products Economics Institute at Ljubljana is connected with the University of Ljubljana. It also makes use of an experimental timber impregnating

station which has treating cylinders made locally. The widespread use of water-borne preservatives for the impregnation of telegraph and transmission poles, by the pressure Boucherie and Osmose processes, is primarily as a result of research work carried on in the institute. It is also noted for exhaustive service tests and service records chiefly in connection with treated transmission poles and local treatment of them.

Research on the treatment of timber with fire retardants is carried on at the Material Preserving Institute in Belgrade which is also known for its technical service in the wide field of the preservation of construction materials.

Research carried on at the Forest Research Institute in Belgrade is mostly concerned with entomology and phytopathology. Work at this institute has resulted in the successful combating of certain groups of wood boring insects (*Ipidae* and *platypodidae*) attacking logs in oak-log storages. Work is also in progress in connection with other insect pests group (*Anobidae* and *Lystidae*), In both cases a number of Jugoslav and foreign formulations have been used.

More recent work includes the listing of Jugoslav wood boring insects and the study of biology of certain kinds of pests (*Platypus cylindrum*) attacking timber. Of major interest are experiments with a view to retarding decay in timber by biological means, making use of antagonistic moulds capable of inhibiting the development of saprophitic fungi. Preliminary laboratory tests have shown that the moulds selected for the purpose had successfully prevented the fructification of one of the most common fungi (*Schyzophyllum commune*) attacking beechwood in Jugoslav forests. Records of beech logs treated with the antagonistic mould show marked retardation of decay as compared with logs free from mould overgrowth.

Subjects of study

The problem of the blue stain fungi attacking pine logs has been lately the subject of study at the new University of Skoplje.

Work on the fire resistance of impregnated mine timber, including fire retardant coatings, is in progress at the mining department at Belgrade University.

Mention should also be made of the work of the Jugoslav Material Preserving Association and the Union of Material Preserving Associations, and of the Jugoslav Engineers' and Technicians' Material Preserving Union which has risen from the former, as timber preservation constitutes a major part of their programmes.

The Jugoslav Material Preserving Association was founded in Belgrade in 1953 in order to bring together all qualified persons interested in the subject and to organise lectures, conventions and practical courses to advocate the advantages of preserving construction materials.

The association was able to realise most of its programme within a relatively short time after its foundation including the foundation of a research laboratory which has grown into the Belgrade Material Preserving Institute. The foundation of associations with the same programme was soon to follow in most Jugoslav republics, and these associations were later on united in the Union of Material Preserving Associations. More recently, as a result of their activities, the Union grew in 1961 into the Jugoslav Engineers' and Technicians' Material Preserving Union with corresponding republican unions. The complex programme of material preservation of the Unions can be put through only by a division of labour among Committees of specialists dealing with separate problems and groups of materials respectively. Thus, for instance the Engineers' and Technicians' Union of the Republic of Serbia has three separate Committees, one of which being the Timber Preserving Committee entitled to function independently within the annual programme of the Union.

Centre to co-ordinate activities

Timber preservation being an important problem in a major timber producing country, the then Jugoslav Union of Material Preserving Associations founded in 1955 the Jugoslav Timber Preservation Centre as an independent body within the union. The aim of the centre is chiefly to co-ordinate activities connected with timber preservation in Jugoslavia, to facilitate the exchange of experiences gained in this field by organising conferences and conventions, and to give useful suggestions and recommendations to republican and federal authorities on the subject of timber preservation. International co-operation is also a part of its programme. The seat of the centre since 1960 is Slavonski Brod, at the experimental station of the Forests Products Research Institute already referred to.

The Timber Preservation Centre has since its foundation organised several successful conventions, and at the latest convention held in 1958 in Sarajevo, which was devoted to timber preservation in mines, a resolution was passed to bring to the notice of the authorities the necessity to introduce the obligatory preservation of all mine timber installed semi-permanently or permanently. The suggestion has so far been accepted by the Republic of Bosnia and Herzegovina, where since the end of 1960 obligatory preservation is being introduced for all mine timber normally requiring preservation. In this connection the Jugoslav Engineers' and Technicians' Material Preserving Union has appointed a Committee of specialsits to prepare a draft-statute providing for the obligatory preservation of timber against decay and fire, especially building and mine timber, as a means of decreasing the drain upon timber resources of the country.

Condensed version of a paper read at the 1961 British Wood Preserving Association annual convention Cambridge earlier this month.

Bees and insecticides

Bees are good friends of farmers and fruit growers, say the M.A.F.F., Don't kill them with insecticides and weed killers at times of spraying and dusting. Co-operation with local beekeepers can do much to save bees from poisoning. As well as producing honey bees do essential work in pollinating fruit and seed crops. Everyone interested in the production of crops, therefore, whether professionally or in the garden, has common interests with the beekeeper in the welfare of bees.

The Ministry of Agriculture, Fisheries and Food appeals for greater co-operation and consultation between beekeepers, farmers, fruit growers, market gardeners, gardeners and spraying contractors to obtain a better understanding of the problems of all parties.

The following precautions should be taken to avoid killing bees:-

1. Don't use insecticidal sprays or dusts on open blossom in orchards or on seed crops in flower, especially rape, mustard and other brassicae which should be sprayed before the blossom opens.
2. Carry out chemical weed control on cereal crops before the weeds reach the flowering stage. This applies particularly to charlock, whose flowers are very attractive to bees.
3. Never use arsenic in orchards except (a) before the flower buds open and (b) after complete petal fall. Arsenic is deadly to bees.
4. Clean, cultivate or gang-mow orchards immediately before applying poisonous chemicals.
5. Avoid letting sprays and dusts drift on to hedgerow flowers or neighbouring fields where bees are foraging.
6. Take care not to dump waste chemicals or empty containers where they might contaminate ponds or other places likely to be used by bees for drinking.
7. Beekeepers should be on the look out for local crops likely to be treated and should approach the growers about the timing of pest control operations or obtain a warning of impending action.

Anti-mosquito experiment

An experiment to combat mosquitoes arranged by the New Zealand Government and the World Health Organisation in the Tokelau Island has shown promising results.

The experiment was carried out by Dr. Marshall Laird, of McGill University (Canada) and Dr. Donald Colless, of the University of Malaya, Singapore.

Spread over two years, the experiment was designed to test whether a native Malayan parasite fungus when transferred to the Pacific could be used to infect the mosquito that transmits filariasis, a widespread disease that may take the form of elephantiasis.

Drs. Laird and Colless attempted to reduce the number of mosquitoes by infecting their larvae with a microscopic fungus.

There was the possibility that once the fungus had taken hold it would perpetuate itself, infecting successive generations of larvae; reducing the size of the adult mosquito population and so limiting the spread of filariasis among human beings.

In 1958, the two scientists introduced their infective material brought from Singapore, in mosquito breeding places on one of the Tokelau atolls. In 1960, Dr. Laird returned to investigate the results. He recently reported back to the W.H.O. that the results achieved so far were sufficiently encouraging for the work to continue.

Faster locust reports

The scope of the Desert Locust Information Service has been extended by the use of current weather data to help in studying and interpreting the current locust situation. Detailed observations of weather over most of the invasion area are now being received daily from meteorological stations in nine of the countries infested by the desert locust.

Apart from other advantages, this is already making possible in some cases the provision of special telegraphed warnings of imminent locust developments affecting individual countries.

The scope and value of these is however dependent on prompt reporting from governments and locust control organisations, and these bodies are now being urged to report immediately by telegram to "Antilocust London" any notable new developments of the locust situation in their areas, in addition to continuing to furnish by air mail, or detailed information on standard forms.

Notable developments should include particularly the first reports of invading swarms, as well as of egg-laying, hatching and fledging, not only in the country as a whole but also within any of its major divisions.

Brief reference is now also being made, in the DLIS monthly situation summaries, to weather features which appear to have been particularly significant in relation to the corresponding locust situation.

Progress of U.K. aerosol makers

The British Aerosol Manufacturers' Association (B.A.M.A.) was formed in January this year and has aroused considerable interest in the U.K. and throughout Europe and the United States. The activities of the association have grown rapidly and an extensive programme of work is reported to be evolving.

The implications of the Weights and Measures Bill on the marketing of aerosols have been discussed with the Board of Trade and it is hoped that there will be amendments as a result of the representations made when the Bill is next given consideration by Parliament. The British Standards Institution has set up a technical committee to prepare British Standards for aerosol containers; furthermore, the Ministry of Transport has been approached on the problem of suitable outer containers for aerosols for export.

This year the B.A.M.A. expects to become a member of the Federation of European Aerosol Associations (F.E.A.) as the national body representing the U.K. industry, and in anticipation of this an invitation from the F.E.A. to organise the 1962 International Aerosol Congress and Exhibition in Britain has been accepted.

The Secretary of the Association is Mr. W. A. Williams, M.B.E., Cecil Chambers, 86 Strand, London. W.C.2.

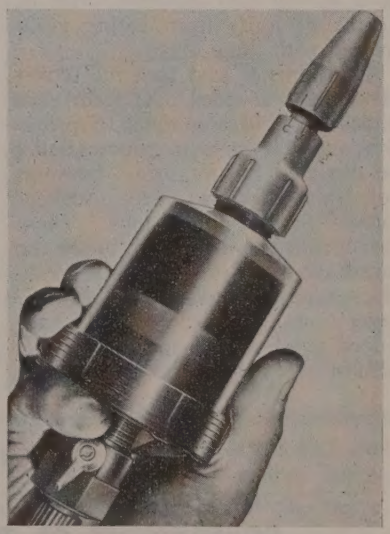
Application for liquid insecticides

A new type of applicator for liquid fertilizers, insecticides or weed killers—namely the Green Spray—is to be manufactured by Greencoat Industries Ltd., S.W.1. The Green Spray, primarily designed for the use of gardeners, fits onto a standard garden hose so that pesticide application becomes as easy as watering the garden.

The Green Spray is made up of an inner transparent container with two graduated scales and a plunger. These are contained within a transparent barrel terminating at one end in a three-position polythene nozzle giving a fine spray, coarse spray, or jet. The other end of the barrel is a screw top combining a hose coupling and a tap to regulate the water from the hose.

To operate the spray the liquid is poured into the inner container and measured on the smaller scale. Water is then added to the larger scale marking—e.g. 1 oz. of liquid insecticide is poured in and if this is to be added to 1 gal. of water, sufficient water is poured in to bring it to the 1 gal. mark. (This mark is a purely relative scale.) The top is screwed on and the whole spray is then attached to the garden hose.

The flow of water between the inner container and the outer barrel draws down a plunger and the mixture is injected into the stream of water in the correct proportion. Using the water control tap in conjunction with the nozzle setting, spraying times varying from four to twenty minutes have been achieved on a full charge. The price of the Green Spray is 37/6d.



The Green Spray Applicator for insecticides, liquid fertilizers, or weed killers.

Large capacity polythene Bottles

Bottles of Rigidex high density polythene are now being offered in 1 gal. and ½ gal. sizes by the Plastics Group of The Metal Box Company.

They are suitable for a very wide range of liquids, including oil in water emulsions, insecticides and disinfectants (except those based on phenol or cresol), many food-stuffs and most water based products (including acids and alkalis).

The new size Poly-Tainers—of a modified square shape to save space in transit—are almost unbreakable, and their weight is negligible in comparison with the weight of the contents.

The translucent self-coloured polythene allows both the colour and level of the contents to be seen, but the Poly-Tainers could be produced in special colours for long runs. Silk screen printing is being offered in one colour, or they may be embossed, or labelled; adhesives are available for both machine and hand labelling.

The wide non-drip easy pouring neck is closed by a black polystyrene cap with special knurling, fitted with a wad faced either with polythene or Vinylite.

Toxic Seed Dressings

Seed dressings containing dieldrin, aldrin and heptachlor will not be used in the United Kingdom at all for spring grown grain, and they will be used only for dressing autumn and winter wheat where there is a real danger of attack from wheat bulb fly, with effect next January.

This, it was announced earlier this month by the Minister of Agriculture in London, has been agreed in talks with interested organisations in the U.K., including the Association of British Manufacturers of Agricultural Chemicals, the National Farmers Union, the National Association of Corn and Agricultural Merchants, Seed Trade Association of the U.K. as well as interested government bodies and groups concerned with the preservation of wild life. The decision follows the results of a survey into reported cases of deaths of birds from eating grain treated with these dressings.

The minister said that the report shows that the widespread occurrence of deaths has been confined to springtime and that the main troubles could be obviated by not using dressings containing diedlrin, aldrin and heptachlor for spring sowings. These arrangements will operate under the terms of the Notification of Pesticides Scheme, and will not involve regulations. The survey is to be continued and a further meeting will be held in June next year to see how the arrangements have worked.

Manufacturers represented at the recent meeting with the ministry have agreed to advise on the proper use of their seed dressings to safeguard wild life, and to supply merchants with appropriate labels to use on sacks of dressed grain. The NACAM and the Seed Trade Association are (a) to recommend their members to supply seed dressings and dressed seed containing aldrin, dieldrin and heptachlor only for the control of wheat bulb fly on autumn-grown grain, where the farmer's crop is in danger of attacks, (b) ensure that every sack of dressed seed bears a label indicating the type of dressing, and an appropriate warning of the risk to wild life, and (c) state clearly in their catalogues the type of dressing which will be applied to seed. The NFU are to warn their members of these measures.

Faster Action

An article in the May 1961 issue of *California Agriculture* published by the University of California, reports that Dibrom (1,2-dibromo-2, 2-dichlorethyl dimethyl phosphate), a relatively new organic phosphate insecticide, can be combined with the sorptive dust Dri-Die 67 to hasten its "knockdown" action.

Previous work, says the report, has shown the effectiveness of Dri-Die 67 against drywood termites, cockroaches, fleas on dogs and cats, the brown dog tick, and other arthropods.

Some ¾lb. to 1lb. of Dri-Die 67 per 1000 square feet of total floor area—including attics and sub-floors areas—has controlled cockroaches in a variety of infested buildings, catering establishments and private homes.

Perfumed Preservatives

Certain wood preservatives used in the eradication of dry rot and woodworm have a smell (unless they are water based and not suitable for the treatment of wood, or expensive deodorised ones which are used in such places as bakeries, public houses, etc.)

Gallwey Pest Control Ltd., of London, are now offering without extra charge their normal water-free organic solvent preservative treatment with three masking perfumes, designed to reduce the inconvenience sometimes experienced through the chemical treatment.

Malathion on Peanuts

Malathion is now registered in the USA for use directly on stored peanuts at levels permitting effective insect control without exceeding the current FDA tolerences. Malathion gives better insect control at lower cost than any previously acceptable method, according to a report by the National Pest Control Association.